CLAIMS

I/We claim:

[c1] 1. A method for processing a microelectronic device, comprising:

fabricating a plurality of dies on an active side of a microelectronic workpiece, the dies having integrated circuitry and bond-pads coupled to the integrated circuitry;

constructing a redistribution assembly on the active side of the workpiece before separating the dies by depositing a dielectric layer over the dies and forming conductive elements having traces connected to corresponding bond-pads on the dies and ball-pads arranged in ball-pad arrays;

covering a backside of the workpiece with a protective material in a flowable state; and

curing the protective material to create a protective layer on the backside of the workpiece.

[c2] 2. The method of claim 1, further comprising:

attaching a plurality of solder balls to the ball-pads; and

covering the dielectric layer with an active side protective film that surrounds at least a portion of the solder balls.

[c3] 3. The method of claim 1 wherein covering the backside of the workpiece comprises stencil printing the material onto the backside of the workpiece.

[c4] 4. The method of claim 1 wherein covering the backside of the workpiece comprises spraying the material onto the backside of the workpiece.

[c5] 5. The method of claim 1 wherein covering the backside of the workpiece comprises spin coating the material onto the backside of the workpiece.

[c6] 6. The method of claim 1 wherein covering the backside of the workpiece comprises applying the material onto the backside of the workpiece in a dip bath.

[c7] 7. The method of claim 1 wherein curing the material comprises heating the material in an environment at a temperature of approximately 50°C to 500°C for approximately 15-150 minutes.

[c8] 8. The method of claim 1 wherein curing the material comprises heating the material in an environment at a temperature of approximately 150°C to 250°C for approximately 15-120 minutes.

[c9] 9. The method of claim 1 wherein curing the material comprises heating the material in an environment at a temperature of approximately 150°C for approximately 120 minutes.

[c10] 10. The method of claim 1 wherein curing the material comprises heating the material in an environment at a temperature of approximately 200°C for approximately 15 minutes.

[c11] 11. The method of claim 1 wherein curing the material comprises heating the material in an environment at a temperature of approximately 250°C for approximately 60 minutes.

[c12] 12. The method of claim 1 wherein the material is a polyimide, epoxy-based, and/or modified silicone material.

[c13] 13. A method for protecting a microelectronic device, comprising:

providing a microelectronic workpiece having an active side, a backside, and a plurality of dies on the active side of the workpiece, wherein the dies include integrated circuitry and bond-pads coupled to the integrated circuitry;

covering the backside of the workpiece with a coating of protective material in a flowable state; and

changing the protective material to a non-flowable state.

[c14] 14. The method of claim 13, further comprising:

providing a redistribution assembly on the active side of the workpiece, the redistribution assembly having a dielectric layer over the dies, ball-pads arranged in ball-pad arrays corresponding to the dies, and traces coupling the bond-pads of a die to the ball-pads of a corresponding ball-pad array;

attaching a plurality of solder balls to the ball-pads; and

covering the dielectric layer with a protective film that surrounds at least a portion of the solder balls.

[c15] 15. The method of claim 13 wherein covering the backside of the workpiece comprises stencil printing the material onto the backside of the workpiece.

[c16] 16. The method of claim 13 wherein covering the backside of the workpiece comprises spraying the material onto the backside of the workpiece.

[c17] 17. The method of claim 13 wherein covering the backside of the workpiece comprises spin coating the material onto the backside of the workpiece.

[c18] 18. The method of claim 13 wherein covering the backside of the workpiece comprises applying the material onto the backside of the workpiece in a dip bath.

[c19] 19. The method of claim 13 wherein changing the protective material to a non-flowable state comprises curing the material by heating the material in an environment at a temperature of approximately 50°C to 500°C for approximately 15-150 minutes.

[c20] 20. The method of claim 13 wherein changing the protective material to a non-flowable state comprises curing the material by heating the material in an environment at a temperature of approximately 150°C to 250°C for approximately 15-120 minutes.

[c21] 21. The method of claim 13 wherein changing the protective material to a non-flowable state comprises curing the material by heating the material in an environment at a temperature of approximately 150°C for approximately 120 minutes.

[c22] 22. The method of claim 13 wherein changing the protective material to a non-flowable state comprises curing the material by heating the material in an environment at a temperature of approximately 200°C for approximately 15 minutes.

[c23] 23. The method of claim 13 wherein changing the protective material to a non-flowable state comprises curing the material by heating the material in an environment at a temperature of approximately 250°C for approximately 60 minutes.

[c24] 24. The method of claim 13 wherein changing the protective material to a non-flowable state comprises curing the material using rapid thermal processing.

[c25] 25. The method of claim 13 wherein the material is a polyimide, epoxy-based, and/or modified silicone material.

[c26] 26. A method for fabricating a microelectronic device, comprising:

providing a microelectronic workpiece having an active side and a backside, the microelectronic workpiece having a plurality of dies on the active side, the dies including integrated circuitry and bond-pads coupled to the integrated circuitry;

fabricating a redistribution layer before separating the dies from each other, the redistribution layer having a dielectric layer over the dies, ball-pads arranged in ball-pad arrays corresponding to the dies, and traces coupling the bond-pads of a die to the ball-pads of a corresponding ball-pad array;

covering the backside of the workpiece with a protective material in a flowable state; and

curing the protective material to create a protective layer on the backside of the workpiece.

[c27] 27. The method of claim 26, further comprising:

attaching a plurality of solder balls to the ball-pads; and

covering the dielectric layer with a protective film that surrounds at least a portion of the solder balls.

[c28] 28. The method of claim 26 wherein covering the backside of the workpiece comprises stencil printing the material onto the backside of the workpiece.

[c29] 29. The method of claim 26 wherein covering the backside of the workpiece comprises spraying the material onto the backside of the workpiece.

[c30] 30. The method of claim 26 wherein covering the backside of the workpiece comprises spin coating the material onto the backside of the workpiece.

[c31] 31. The method of claim 26 wherein covering the backside of the workpiece comprises applying the material onto the backside of the workpiece in a dip bath.

[c32] 32. The method of claim 26 wherein curing the material comprises heating the material in an environment at a temperature of approximately 50°C to 500°C for approximately 15-150 minutes.

[c33] 33. The method of claim 26 wherein curing the material comprises heating the material in an environment at a temperature of approximately 150°C to 250°C for approximately 15-120 minutes.

[c34] 34. The method of claim 26 wherein curing the material comprises heating the material in an environment at a temperature of approximately 150°C for approximately 120 minutes.

[c35] 35. The method of claim 26 wherein curing the material comprises heating the material in an environment at a temperature of approximately 200°C for approximately 15 minutes.

[c36] 36. The method of claim 26 wherein curing the material comprises heating the material in an environment at a temperature of approximately 250°C for approximately 60 minutes.

[c37] 37. The method of claim 26 wherein curing the material comprises changing the material from a flowable state to a non-flowable state using rapid thermal processing.

[c38] 38. The method of claim 26 wherein the material is a polyimide, epoxy-based, and/or modified silicone material.

[c39] 39. A microelectronic workpiece used at a stage in manufacturing a plurality of microelectronic devices, comprising:

a substrate having a device side and a backside;

a plurality of dies formed on the device side of the substrate, the dies having integrated circuitry and a plurality of bond-pads electrically coupled to the integrated circuitry;

a redistribution layer having a dielectric layer over the dies, ball-pads arranged in ball-pad arrays corresponding to the dies, and traces coupling the bond-pads of the dies to the ball-pads of corresponding ball-pad arrays; and

a protective layer formed on the backside of the substrate, wherein the protective layer is in a flowable state.

[c40] 40. The microelectronic workpiece of claim 39, further comprising:

a plurality of solder balls on the ball-pads; and

a protective film over the redistribution layer and surrounding a portion of the solder balls.

[c41] 41. The microelectronic workpiece of claim 39 wherein the flowable material is curable to a non-flowable state at approximately 50°C to 500°C.

[c42] 42. The microelectronic workpiece of claim 39 wherein the protective layer comprises a polyimide, epoxy-based, and/or modified silicone material.

[c43] 43. The microelectronic workpiece of claim 39 wherein the integrated circuitry comprises a memory circuit.

[c44] 44. A microelectronic workpiece for manufacturing a plurality of microelectronic devices, comprising:

a substrate having a device side and a backside;

a plurality of dies formed on the substrate, the dies having integrated circuitry and a plurality of bond-pads electrically coupled to the integrated circuitry;

a dielectric layer over the dies;

a plurality of ball-pads on the dielectric layer arranged in ball-pad arrays over corresponding dies on the substrate, wherein the ball-pads of one array are electrically coupled to the bond-pads of a corresponding die; and

a protective layer formed on the backside of the substrate, wherein the protective layer is a flowable material.

[c45] 45. The microelectronic workpiece of claim 44, further comprising:

a plurality of solder balls on the ball-pads; and

a protective film over the dielectric layer and surrounding a portion of the solder balls.

[c46] 46. The microelectronic workpiece of claim 44 wherein the flowable material is curable to a non-flowable state in an environment at a temperature of approximately 50°C to 500°C.

[c47] 47. The microelectronic workpiece of claim 44 wherein the protective layer comprises a polyimide, epoxy-based, and/or modified silicone material.

[c48] 48. The microelectronic workpiece of claim 44 wherein the integrated circuitry comprises a memory circuit.

[c49] 49. A semiconductor workpiece for fabricating a plurality of semiconductor devices, comprising:

a wafer having a substrate composed of a semiconductor material, the substrate having an active side and a backside;

a plurality of dies having integrated circuitry on the active side of the substrate and a plurality of bond-pads electrically coupled to the integrated circuitry; and

a protective layer formed on the backside of the substrate, wherein the protective layer is a flowable material.

[c50] 50. The semiconductor workpiece of claim 49, further comprising:

a redistribution layer having a dielectric layer over the dies, ball-pads arranged in ball-pad arrays corresponding to the dies, and traces coupling the bond-pads of a die to the ball-pads of a corresponding ball-pad array;

a plurality of solder balls on the ball-pads; and

a protective film over the dielectric layer and surrounding a portion of the solder balls.

[c51] 51. The semiconductor workpiece of claim 49 wherein the flowable material is curable to a non-flowable state in an environment at a temperature of approximately 50°C to 500°C.

[c52] 52. The semiconductor workpiece of claim 49 wherein the protective layer comprises a polyimide, epoxy-based, and/or modified silicone material.

[c53] 53. The semiconductor workpiece of claim 49 wherein the integrated circuitry comprises a memory circuit.

[c54] 54. A semiconductor device, comprising:

a semiconductor substrate having a device side and a backside;

a die on the device side of the substrate, the die having integrated circuitry and a plurality of bond-pads electrically coupled to the integrated circuitry;

a dielectric layer over the device side;

a plurality of ball-pads arranged in a ball-pad array on the dielectric layer over the die, wherein the ball-pads are electrically coupled to corresponding bond-pads of the die; and

a protective layer formed on the backside of the substrate, wherein the protective layer is a flowable material.

[c55] 55. The semiconductor device of claim 54, further comprising:

a plurality of solder balls on the ball-pads; and

a protective film over the dielectric layer and surrounding a portion of the solder balls.

[c56] 56. The semiconductor device of claim 54 wherein the flowable material is curable to a non-flowable state in an environment at a temperature of approximately 50°C to 500°C.

[c57] 57. The semiconductor device of claim 54 wherein the protective layer comprises a polyimide, epoxy-based, and/or modified silicone material.

[c58] 58. The semiconductor device of claim 54 wherein the integrated circuitry comprises a memory circuit.

[c59] 59. A microelectronic device, comprising:

a substrate having a device side and a backside;

a die formed on the device side of the substrate, the die including integrated circuitry and a plurality of bond-pads electrically coupled to the integrated circuitry; and

a protective layer coating the backside, the protective layer being configured to change from a flowable state to a non-flowable state.

[c60] 60. The microelectronic device of claim 59, further comprising:

a redistribution layer having a dielectric layer over the dies, ball-pads arranged in ball-pad arrays corresponding to the dies, and traces coupling the bond-pads of a die to the ball-pads of a corresponding ball-pad array;

a plurality of solder balls on the ball-pads; and

a protective film over the dielectric layer and surrounding a portion of the solder balls.

[c61] 61. The microelectronic device of claim 59 wherein the flowable material is curable to a non-flowable state in an environment at a temperature of approximately 50°C to 500°C.

[c62] 62. The microelectronic device of claim 59 wherein the protective layer comprises a polyimide, epoxy-based, and/or modified silicone material.

[c63] 63. The microelectronic device of claim 59 wherein the integrated circuitry comprises a memory circuit.

[c64] 64. A microelectronic workpiece having a front-side and a backside opposite the front side, the microelectronic workpiece comprising:

a die having an integrated circuit;

a bond-pad electrically coupled to the integrated circuit; and

a protective layer formed on the backside of the microelectronic workpiece, wherein the protective layer includes a flowable material.

[c65] 65. The microelectronic workpiece of claim 64 wherein the flowable material is curable to a non-flowable state in an environment at a temperature of approximately 50°C to 500°C.

[c66] 66. The microelectronic workpiece of claim 64 wherein the protective layer comprises a polyimide, epoxy-based, and/or modified silicone material.

[c67] 67. A semiconductor workpiece for fabricating a plurality of semiconductor devices, comprising:

a wafer having a substrate composed of a semiconductor material, the substrate having a device side and a backside;

a plurality of dies having integrated circuitry on the active side of the substrate and a plurality of bond-pads electrically coupled to the integrated circuitry; and

protection means configured to protect the backside of the substrate, the protection means including a flowable material that can be cured to a non-flowable state.